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(54) CANCER ELECTROCHEMICAL-THERAPEUTIC DEVICE USING ELECTROTHERMAL NEEDLES

(57) A cancer electrochemical-therapeutic device using electrothermal needles, comprising two groups of electrothermal needles and three D.C. power supplies, each group having at least one electrothermal needle, two of the three D.C. power supplies - serving as heating power supply - being connected to the groups of electrothermal needles to heating them to realize electrothermal therapy, and the other D.C. power supply - serving as electrochemical power supply - being connected to the corresponding electrodes of the D.C. power supplies to realize electrochemical therapy between twoelectrothermal needles. The device is simple, easy to use and reliable, its cost is low and its therapy effect is good.

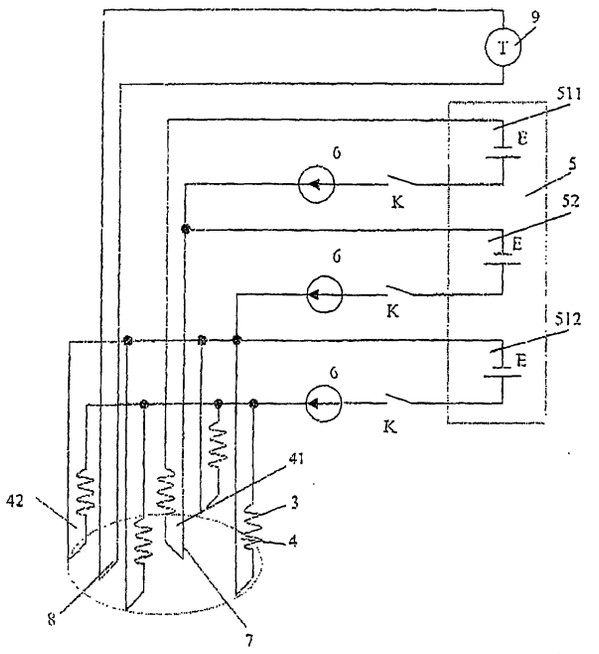

Fig.1

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Description

Field of the Invention

[0001] The present invention relates to a device which is a kind of the therapy instrument, in which the electrothermal needles are used as the electrodes for tumor electrochemical therapy, whereby the electrothermal therapy can be effected in addition.

Background of the Invention

[0002] The electrothermal needles and the electrochemistry techniques have been used separately for the tumor therapy for a history of more than ten years, the current that is produced after switching on the power supply is used by both techniques, one for activating the heating body within the hollow body of the electrothermal needle to produce heat and effecting the heat on the tumor focus tissue where the electrothermal needles are inserted, and another for activating both the positive and negative electrodes which are inserted into the tumor focus so that the electrode reaction and the electrode sub-reaction are occurred between both the positive and negative electrodes, and the concentrated acid and alkali killing regions are produced respectively between both electrodes to achieve the result of the electrochemistry therapy. Because two techniques for the tumor therapy are used separately in clinic, the temperature of the therapy in which only the electrothermal needles for treating the tumor focus are used is difficult to control; especially, the temperature can not be increased evenly when the diameter of the tumor tissue is large. Although the tumor cells can be killed by using the electrochemistry therapy only, but the problems, such as uneven, as well as being unable to synchronize and etc., still exist.

Summary of the Invention

[0003] The object of the invention is to overcome the above disadvantages, and by being aimed at utilizing the features of the coordination, supplement, and effectiveness of the electrothermal needles and the electrochemical-therapy techniques at the effective mechanism of the physics, chemistry, and biology to integrate effectively the electrothermal needles and the electrochemical-therapeutic techniques as a whole to provide a tumor electrochemical-therapeutic device using electrothermal needles.

[0004] The object of the invention is realized by using the following technical scheme, and it is constructed by at least two groups of the electrothermal needles and three D. C. power supplies, wherein, at least one electrothermal needle within which a heating body is placed is involved in each group; wherein two of the three D. C. power supplies connected respectively to the heating bodies within the two groups of electrothermal needles are used as the heating power supplies, and the other power supply is used as the electrochemical power supply with its two electrodes connected respectively to the corresponding electrodes of two heating power supplies.

[0005] The electrothermal needle of the invention includes a group of the center electrothermal needles comprising at least one electrothermal needle, and a group of the surrounding electrothermal needles comprising at least two electrothermal needles; the center electrothermal needle has a heating power supply with its one electrode (e.g. positive electrode) connected to the same electrode (e.g. the positive electrode) of the electrochemical power supply, and the another corresponding electrode (e.g. the negative electrode) of the heating power supply for surrounding electrothermal needle is connected to another same electrode (e.g. the negative electrode) of the electrochemical power supply.

[0006] Both the heating power supply and the electrochemical power supply are floating D. C. constant current adjustable power supply, wherein the magnitude of electrochemical current can be adjusted by the electrochemical power supply, and the heating temperature of electrothermal needle can be adjusted by the heating power supply.

[0007] The electrothermal needle of the invention is a hollow needle body made of stainless steel with a heating body made of nickrome filament placed inside, and the center electrothermal needle is coated with platinum.

[0008] A temperature detection needle is also provided in the invention, it is constructed by inserting and isolating a thermal sensor for detecting the temperature into and from the hollow needle body made of stainless steel, and a temperature indicator is connected to the thermal sensor for detecting the temperature.

Brief Description of the Drawings

[0009]

Fig. 1 is a schematic view of the structure of the invention; and

Fig. 2 is a schematic view of the structure of the electrothermal needle of the invention.

Description of the Preferred Embodiments

[0010] The invention will be explained from the detailed description set forth below when taken in conjunction with the drawings. As shown in Fig. 2, the electrothermal needle structure of the invention includes a stainless steel hollow needle body 1; a sharp needle head part 2 at the front end of the needle body 1; and a heating body 3 made of the nickrome filament, one end of which is connected to the sharp needle head part 2, and the other end is connected to an electrode of the

power supply. Another electrode of the power supply is connected to the needle body 1 to form a current loop. After the current flowing through the heating body 3, the heat will be produced. Since the above structure of the electrothermal needle has been published on the Chinese Patent Document as a known technology, it will not be explained in detail herein. As shown in Fig. 1, the present embodiment comprises mainly five electrothermal needles 4 with the heating body 3 placed inside, and three floating D. C. constant current adjustable power supply 5 which are separated with each other. The electrothermal needles 4 are divided into two groups, a center electrothermal needle 41 is construsted by one electrothermal needle in one group, and the surrounding electrothermal needle 42 is constructed by four electrothermal needles in another group; two power supplies in the power supply 5are the heating power supplies 51, wherein two electrodes of the heating power supply 511 are connected to the center electrothermal needle, and two electrodes of another heating power supply 512 are connected in parallel to four surrounding electrothermal needles; another power supply in the power supply 5 is the electrochemical power supply 52, the positive electrode of which is connected to the positive electrode of the heating power supply 511, and the negative electrode of which is connected to the negative electrode of the heating power supply 512. In another embodiments of the invention, the positive and negative electrodes of the electrochemical power supply can be connected in a reverse fashion. That is, the positive electrode of which can be connected to the positive electrode of the heating power supply 512, and the negative electrode of which can be connected to the negative electrode of the heating power supply 511. In the loop of the above power supply 5, switches K and current adjusters 6 are also deposed, so that the temperature of the electrothermal needles can be controlled by adjusting the heating current; as well as the magnitude of the electrochemical current I can be achieved by adjusting the current adjuster 6. When operating, the heating power supply is switched on, so that the heat will be produced by the center electrothermal needle 41 and the surrounding electrothermal needle 42, and the heat effect to the tumor will be occurred. When only the electrochemical power supply is 52 switched on, the current will be produced between the center electrothermal needle 41 and the surrounding electrothermal needle 42, that is, the electrochemical-therapeutic effect will be produced between the electrothermal needles 4, and the chemical reaction will be occurred in the tumor tissue, that is, the concentrated acid and alkali regions are produced at one end and the other end of the electrothermal needles. When the heating power supply 51 and the electrochemical power supply 52 are switched on at the same time, the tumor tissue is effected by the electrothermal therapy effect and the electrochemical therapy effect produced by both of them simultaneously, so that the killing effect to the tumor tissue can be increased.

[0011] The structure of the center electrothermal needle 41 described in the invention is similar as that of the surrounding electrothermal needle 42, but it is coated with the platinum 7 for avoiding from the corrupting effect of the chemical procedure.

[0012] A temperature detection needle 8 is also provided in the invention, it is constructed by inserting and isolating a thermal sensor for detecting the temperature into and from the hollow needle body made of stainless steel, and a temperature indicator is connected to the thermal sensor for detecting the temperature.

[0013] The center electrothermal needle 41 may be substituded by an electrode needle made of the platinum filament.

[0014] Another embodiment of the invention includes the center electrothermal needle 41 which is comprised of two or more electrothermal needles 4 and the surrounding electrothermal needle 42 which is comprised of three or more electrothermal needles. The power supply 5 may be comprised of several heating power supplies 51 to form heating power supply group, or may be comprised of several electrochemical power supplies 52 to form electrochemical power supply group. Switching on the heating body 3 within the electrothermal needle 4 and producing heat thereof is mainly used by the invention to produce the electrothermal therapy effect; two electrothermal needles are used as both the positive and the negative electrodes of the power supply, then the current will be produced so that electrochemical therapy effect will be occurred in the tumor tissue.

[0015] Because in the invention, a group of the electrothermal needles heating internally is used as one electrode which is inserted into the tumor tissue from the periphery of the tumor focus; and an electrothermal needle which is coated with the platinum is used as another electrode to insert into the center of the tumor focus. When the constant current is applied to each needle, the electrode reaction and the electrode sub reaction are occurred between the cathode and the anode where the electrode is their shaft, and the concentrated acid and alkali killing regions are produced respectively. The killing effect of these killing substances can be increased under the heat effect. According to the law of the chemistry dynamics, the temperature of the chemical reaction system increases per 10°C, the reaction speed of which will increase 2-3 times, so that the therapy result will be improved significantly. Additionally, the enhanced dissolution effect of the acid (HCL PH 2-3) formed in the anode region and the alkali (NaOH PH 12-13) formed in the cathode region will enlarge and increase the space and the canal between the cells, the heat and the killing substances produced at the electrodes of the electrothermal needles can be spread quickly to nearby regions by the above effect, so that the unevenness of the therapy that occurred while utilizing separately the electrothermal therapy and the electrochemical therapy can be improved significantly. Moreover, after cooperating both therapy, the killing ef-

fect of the cells, the coagulation effect of the blood, and the systolic effect of the blood vessels will be enhanced by the electrochemical therapy; and the possibility of the tumor cells transferring caused by the expand of the tissue volume, the looseness of the cell connection, the expand of the blood vessel, and quickening the blood flow rate which are caused by the heat effect will also be decreased. Finally, the therapy dosage will be less than that the two therapies are used separately, the therapy period will decrease, and the patient's pain decreases. Two therapy functions are integrated by the invention. They can be used separately or integrally, as well as one function can be used before or after the other one, and thus the therapy result of the entire instrument increases significantly, but the cost of the entire instrument have not been increased.

Claims

1. A tumor electrochemical-therapeutic device using electrothermal needles, wherein said device is constructed by at least two groups of the electrothermal needles and three D. C. power supplies (5), and at least one electrothermal needle (4) within which a heating body (3) is placed is involved in each group; wherein two of the three D. C. power supplies connected respectively to the heating bodies (3) within the two groups of electrothermal needles are used as the heating power supplies (51), and the other power supply is used as the electrochemical power supply (52) with its two electrodes connected respectively to the corresponding electrodes of two heating power supplies.

2. The tumor electrochemical-therapeutic device using electrothermal needles as Claim 1, wherein said electrothermal needles include a group of the center electrothermal needles (41) comprising at least one electrothermal needle (4), and a group of surrounding electrothermal needles (42) comprising at least two electrothermal needles (4); an electrode of the heating power supply (511) for center electrothermal needle (41) is connected to the same electrode of the electrochemical power supply(52), and another corresponding electrode of the heating power supply for surrounding electrothermal needle (42) is connected to another same electrode of the electrochemical power supply (52).

3. The tumor electrochemical-therapeutic device using electrothermal needles as Claim 2, wherein both said heating power supply (51) and electrochemical power supply (52) are the floating D. C. constant current adjustable power supply, wherein the magnitude of electrochemical current can be adjusted by the electrochemical power supply, and the heating temperature of electrothermal needles can be adjusted by the heating power supply.

4. The tumor electrochemical-therapeutic device using electrothermal needles as Claim 1, 2, or 3, wherein said electrothermal needle (4) is a hollow needle body made of stainless steel, with the nickrome filament heating body (3) placed inside, and said center electrothermal needle (41) is coated with platinum (7).

5. The tumor electrochemical-therapeutic device using electrothermal needles as Claim 4, wherein said electrothermal needle (4) is provided with a temperature detection needle (8), said temperature detection needle (8) is constructed by inserting and isolating a thermal sensor for detecting the temperature into and from the hollow needle body made of stainless steel; and a temperature indicator is connected to the thermal sensor for detecting the temperature.

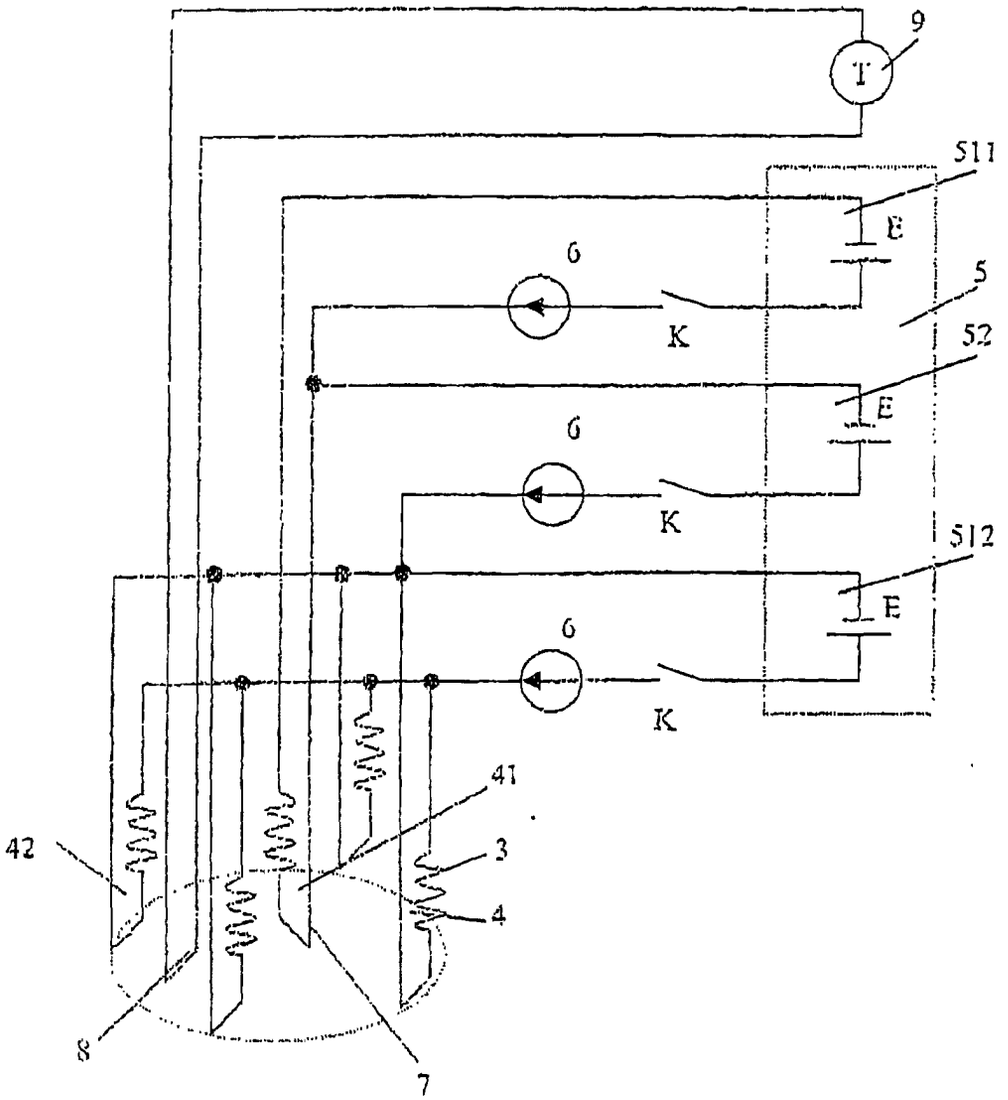

Fig.1

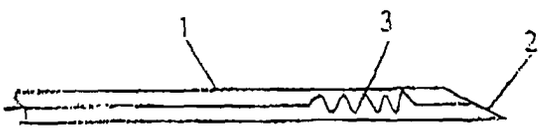

Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN00/00073

A. CLASSIFICATION OF SUBJECT MATTER

IPC^{7}A61N1/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61N, A61H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

中文检索, EPODOC, WPI, 肿瘤, electrothermal, heating ,needle, cancer

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 1163150A , 29.Oct. 1997(29.10.97)	1-5
A	CN 2057590U, 30. May 1990(30.05.90)	2,4

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11.July 2000(11.07.00)	03 AUG 2000 (03.08.00)
Name and mailing address of the ISA/CN 6 Xitucheng Rd., Jimen Bridge, Haidian District, 100088 Beijing, China Facsimile No. 86-10-62019451	Authorized officer 钟强 Telephone No. 86-10-62093827

Form PCT/ISA /210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN00/00073

CN 1163150A	29.Oct. 1997	None
CN 2057590U	30.May 1990	None

Form PCT/ISA /210 (patent family annex) (July 1998)